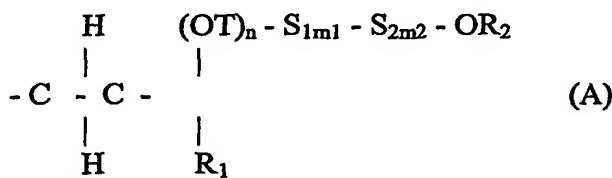


Claims

1. A cement additive containing copolymers comprising one or more constitutional units represented by formula A:



wherein

$\text{R}_1$  is hydrogen, an alkyl group having 1 to 4 carbon atoms, an alkenyl group having 1 to 4 carbon atoms or an aryl group having 6 to 9 carbon atoms;

$\text{R}_2$  is hydrogen or an alkyl group having 1 to 9 carbon atoms, an alkenyl group having 1 to 9 carbon atoms or an aryl group having 6 to 9 carbon atoms;

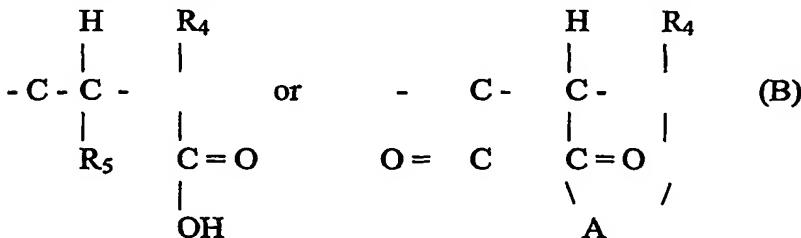
$\text{T}$  is alkylene (including straight-chain and branched alkylene) having 1 to 4 carbon atoms or arylene having 6 to 9 carbon atoms;

$n$  is 0 or 1;

$\text{S}_1$  and  $\text{S}_2$  are, independently of one another,  $-\text{OC}_k\text{H}_{2k-}$  or  $-\text{OCH}_2\text{CHR}_3-$ , with the proviso that  $k$  is 2 or 3,  $\text{R}_3$  is an alkyl group having 1 to 9 carbon atoms, an aryl group having 6 to 9 carbon atoms; and

$6 \leq m_1 + m_2 \leq 25$ ;

one or more constitutional units represented by formula B:



wherein

$\text{R}_4$  is hydrogen or a methyl group;

$\text{R}_5$  is hydrogen or a group represented by  $\text{COOY}$ ;

$\text{Y}$  is hydrogen, an aliphatic hydrocarbon group (including straight-chain, branched, saturated and unsaturated groups) having 1 to 8 carbon atoms, a cyclic hydrocarbon group (including straight-chain, branched, saturated and unsaturated groups) having 3 to 8 carbon atoms, a hydroxyalkyl group (including branched groups) having 2 to 5 carbon atoms, a hydroxyalkenyl group having 2 to 5 carbon atoms, metal (oxidation number I or II), an ammonium group derived from alkylamine having 1 to 20 carbon atoms, alkanolamine having 1 to

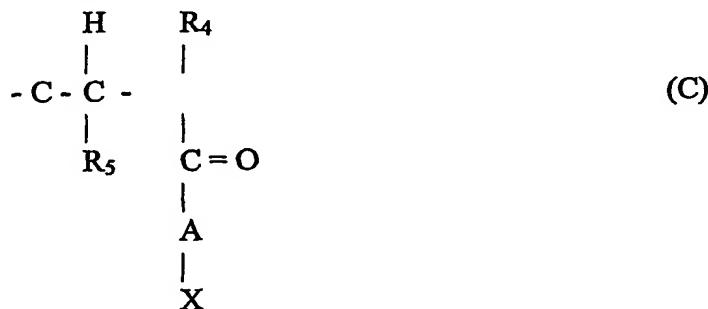
20 carbon atoms, cycloalkylamine having 5 to 8 carbon atoms, arylamine having 6 to 14 carbon atoms;

A is oxygen or  $NR_6$ ; and

$R_6$  is hydrogen, an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, a sulfonyl group or a sulfanyl group;

and

one or more constitutional units represented by formula C:



wherein

$R_4$ ,  $R_5$  and A have the same meaning as in formula B;

X is an aliphatic hydrocarbon group (including straight-chain, branched, saturated and unsaturated groups) having 1 to 8 carbon atoms, a cyclic hydrocarbon group (including straight-chain, branched, saturated and unsaturated groups) having 3 to 8 carbon atoms, a hydroxyalkyl group (including branched groups) having 2 to 5 carbon atoms, a hydroxyalkenyl group having 2 to 5 carbon atoms, metal (oxidation number I or II), an ammonium group derived from alkylamine having 1 to 20 carbon atoms, alkanolamine having 1 to 20 carbon atoms, cycloalkylamine having 5 to 8 carbon atoms, arylamine having 6 to 14 carbon atoms.

2. The cement additive according to claim 1 wherein the average molecular weight of the copolymers is 5,000 to 50,000.

3. The cement additive according to claims 1 or 2 comprising copolymers wherein the mole ratio of the constitutional units A and C is  $A/C \geq 0.1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 20$ .

4. The cement additive according to any of claims 1 to 3 having slump retaining properties and comprising copolymers wherein the mole ratio of the constitutional units A and C is  $0.1 \leq A/C \leq 1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 1$ .

5. The cement additive according to any of claims 1 to 3 having dispersing properties and comprising copolymers wherein the mole ratio of the constitutional units A and C is  $A/C > 1$  and the mole ratio of the constitutional units B and C is  $1 < B/C \leq 20$ .

6. The cement additive according to any of claims 1 to 3 comprising copolymers wherein the mole ratio of the constitutional units A and C is  $0.1 \leq A/C \leq 1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 1$ , and copolymers wherein the mole ratio of the constitutional units A and C is  $A/C > 1$  and the mole ratio of the constitutional units B and C is  $1 < B/C \leq 20$ .

7. The cement additive according to claim 6 comprising copolymers wherein the mole ratio of the constitutional units A and C is  $0.1 \leq A/C \leq 1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 1$ , and copolymers wherein the mole ratio of the constitutional units A and C is  $A/C > 1$  and the mole ratio of the constitutional units B and C is  $1 < B/C \leq 20$  in a ratio of 20:80 to 99:1.

8. The cement additive according to any of claims 1 to 7 further comprising one or more of additive I selected from the group consisting of polycarboxylic acid type copolymers comprising vinyl alcohol; polycarboxylic acid type copolymers; copolymers of alkyl vinyl ether and acrylic acid derivatives; copolymers of hydroxyalkyl vinyl ether and acrylic acid derivatives; copolymers of vinyl alcohol derivatives and acrylic acid derivatives; copolymers of vinyl ether, acrylic acid and maleic acid; copolymers of allyl ether and maleic anhydride; copolymers of allyl ether, maleic anhydride and maleic acid ether; copolymers of methacrylate alkylene oxide ether and methacrylic acid; copolymers of methacrylate alkylene oxide ether and acrylic acid; maleic acid esters; copolymers of maleic acid and styrene; ligninsulfonic acid; polymelaminesulfonic acid; bis-naphthalenesulfonic acid and gluconic acid.

9. The cement additive according to claim 8 comprising cement additive I and copolymers wherein the mole ratio of the constitutional units A and C is  $0.1 \leq A/C \leq 1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 1$ ; wherein cement additive I is comprised in a ratio of 1 to 60 wt% of the total amount of cement additives.

10. The cement additive according to claim 8 comprising cement additive I and copolymers wherein the mole ratio of the constitutional units A and C is  $A/C > 1$  and the mole

ratio of the constitutional units B and C is  $1 < B/C \leq 20$ ; wherein cement additive I is 50 wt% or more of the total amount of cement additives.

11. The cement additive according to claim 8 comprising cement additive I, copolymers wherein the mole ratio of the constitutional units A and C is  $0.1 \leq A/C \leq 1$  and the mole ratio of the constitutional units B and C is  $B/C \leq 1$ , and copolymers wherein the mole ratio of the constitutional units A and C is  $A/C > 1$  and the mole ratio of the constitutional units B and C is  $1 < B/C \leq 20$ ; wherein cement additive I is comprised in a ratio of 1 to 99 wt% of the total amount of cement additives.

12. The cement additive according to claims 1 to 11 further comprising one or more of cement additive II selected from the group consisting of gluconic acid, sodium gluconate, saccharides, sugar alcohols, lignin, polycarboxylic acid, polyamide, polyamine, polyethoxyethylene, triethanolamine, commonly used air-entraining agents, polysaccharide derivatives, lignin derivatives, dry shrinkage reducing agents, accelerators, retarding agents, foaming agents, defoaming agents, rust preventing agents, quick setting agents, thickeners and water-soluble high molecular substances.

13. The cement additive according to claim 12 wherein cement additive II is 40 wt% or less of the total amount of cement additives.